REMARKS

Applicants acknowledge receipt of the Office Action dated September 22, 2004, in which the Examiner objected to the specification; rejected claims 1-20 under § 112, second paragraph; rejected claims 1, 16, 17, and 18 as anticipated by the Oldenburg paper; rejected claims 1-10, 13, and 16 as anticipated by Schultz (US 6180415); rejected claims 11, 12, 14, 14, 17 and 18 as obvious in view of Schults in view of Birnboim (US 5023139); and rejected claims 19 and 20 as obvious in view of Schultz and the Sarkar paper (*Plasmon Resonance Shifts of Au-coated Au_2 Nanoshells: Insight into Multicomponent Nanoparticle Growth*, the American Physical Society, June 1997 pp. 4217-4220). Applicants respectfully traverse these rejections for the following reasons and respectfully request reconsideration and withdrawal of the rejections.

Amendment to the Specification:

Regarding priority, Applicants respectfully submit that the present claims are in fact entitled to the priority as claimed, namely to priority back to co-pending U.S. Patent Application No. 09/038,377 filed March 11, 1998, now U.S. Patent No. 6,344,272. Claim 1 has been amended to replace the limitation on the thickness of the shell layer with equivalent language that is explicitly supported in that parent case, whose disclosure was incorporated in the present case. Throughout its specification, the '272 patent discusses the relevance of the threshold thickness above which the bulk dielectric properties of the shell material govern the properties of the shell, making it non-tunable. Specifically for example, at col. 3, lines 59-64, that patent reads:

> Most importantly, while the metal nanoshells of the present invention may be much smaller than a wavelength of light, they are not limited in the thickness of their metal shells to account for the bulk dielectric properties of the metal comprising the shell. In fact, due to the one-atom-or-molecule-at-a-time approach to building the metal shell disclosed by the present inventors, the thickness of the metal shell may be controlled from as low as atomic thicknesses.

Applicants submit that because this limitation is supported by the parent disclosure(s), the present application is entitled to the claimed priority.

Applicants have also amended the specification to include the present status of the parent applications. Applicants note that the Examiner refers to the present application as Serial No. "10/789,543," when its actual serial number is **10/789,542**.

Claims 13-15 have been amended to more clearly recite the intended limitations without altering their scopes.

§ 112, second paragraph, Rejection of claims 1-20

The Examiner asserts that the phrase "bulk electron mean free path of the material" is vague and indefinite. Applicants respectfully submit that 1) that the phrase "bulk electron mean free path" is well known to those of skill in the art and 2) the rejection is moot because the phrase in question has been replaced. By way of example only, Applicants attach hereto a paper entitled *Size-Dependent Photoconductivity in CdSe Nanoparticles as Measured by Time-Resolved Terahertz Spectroscopy*, nano Lett., 2002,Vol. 2, No. 9., pp. 983-987, which sets out a standard definition of the bulk electron mean free path. Regardless, the phrase has been replace with "bulk dielectric properties, which is similarly well-known and understood in the art.

Applicants respectfully traverse the Examiner's assertion that the term "the material" is vague, inasmuch as the claim term reads in full "the material comprising the shell layer." Applicants submit that anyone reading the claim would fully understand that the term in question refers to the material of which the shell layer is made.

Claim 12 has been amended to depend from claim 11 instead of from claim 1, thereby curing the grounds for rejection of this claim as indefinite.

§ 102 Rejection of claims 1, 16, 17, and 18 as anticipated by the Oldenburg paper

Applicants respectfully submit that this rejection is obviated by the applicants establishment of entitlement to priority as originally claimed.

§ 102 Rejection of claims 1-10, 13, and 16 as anticipated by Schultz (US 6180415)

Claims 1-10, 13, and 16 stand rejected under 35 U.S.C. § 102(e) as being anticipated by *Schultz et al.* It is the Examiner's position that *Schultz et al.* disclose:

> "resonant scattering particles comprised of a dielectric core (non-conducting) and an outer shell comprised of gold or silver. Schultz et al disclose that these particles may be used in diagnostic applications. The particles have surface-attached ligands adapted to bind to ligand-binding sites on a target. Schultz et al disclose that the ligands are one of the members of a conjugate part that can include antigen/antibody, enzyme/substrate. Schultz et al disclose that different surface localized molecules may be different ligands effective to bind to different ligand-binding sites. Schultz et al also disclose that the particles have a spectral emission

wavelength in one of three ranges >700 nm, 400-700 nm, and <400 nm. Schultz et al disclose that these particles can be tuned to a desired frequency. Schultz et al also disclose that these particles are capable of inducing surface enhanced Raman scattering. Schultz et al also disclose that these particles are immobilized to a substrate (support) and the optical scattering parameters of each particle are recorded. Schultz et al also disclose that the substrate may be nitrocellulose (permeable material). Schultz et al also disclose that these particles can be arrayed on a support such as glass. Schultz et al disclose that these particles can be used in sandwich, direct and indirect assays."

To anticipate a claim, a single source must contain all the elements of the claim. *See Hybritech Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1379, 231 U.S.P.Q. 81, 90 (Fed. Cir. 1986). With respect to independent claim 1, Applicants assert that *Schultz et al.* fail to teach every recited element in the claims. Specifically, *Schultz et al.* fails to teach particles having a shell layer with a thickness that is less than the thickness of a shell layer whose properties are described by a bulk dielectric property.

In *Schultz et al.*, gold colloid nucleating centers are attached to a substrate by chemically treating one or more spatially pre-specified positions of the substrate (*e.g.* using Alcian blue). See Example 1 of *Schultz et al.* The gold colloid is then covered with an enhancer solution (*e.g.* silver solution) for a predetermined time. See Example 2 of *Schultz et al.* See also col. 24, lines 16-52. Thus, in *Schultz et al.*: A) the core is attached to a substrate or support via Alcian blue; and B) after attachment to a substrate, the core is enhanced with a silver exterior. In *Schultz et al.*, the core is a nucleating center that is enhanced by a silver exterior, producing "larger silver masses which can be visible under an electron and/or light microscope" (Col. 26, ll. 8-10 of *Schultz et al.*) *Schultz et al.'s* statement that their method produces "particles [that] possess the properties of plasmon resonance particles" (Col. 26, ll. 43-46 of *Schultz et al.*) is not meaningful in the context of the present rejection, as plasmon resonance is part of the background technology of the present case. What *is* significant is that the particles made by the method disclosed in *Schultz et al* possess the plasmon resonance of a solid metal particle.

The Examiner appears to assert that *Schultz et al* may anticipate a nanoparticle having a shell thickness that is less than the bulk electron mean free path. This is not the case. As described above, that the particles made by the method disclosed in *Schultz et al* possess the plasmon resonance of solid metal particles and therefore cannot have a shell thickness that is less than the bulk electron mean free path. While it is true that *Schultz et al* mention "a particle with a dielectric core and an outer silver shell of at least about 5 nm," it is also true that such a particle is quite

likely to have a shell thickness greater than the bulk electron mean free path (i.e., a "bulk dielectric property.")

Applicants respectfully point out that it is well established that claimed subject matter missing from the allegedly anticipatory reference is inherently disclosed only if it is necessarily present in the reference:

> Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient. If, however, the disclosure is sufficient to show that the natural result flowing from the operation as taught would result in the performance of the questioned function, it seems to be well settled that the disclosure should be regarded as sufficient.

Continental Can Co. USA, Inc. v. Monsanto Co., 948 F.2d 1264, 1268-69, 20 U.S.P.Q.2d 1746, 1749 (Fed. Cir. 1991). The possibility that the missing subject matter might be present in the prior art reference does not meet this standard. Instead, the missing subject matter asserted as inherent must be present to a certainty.

Applicants assert that for at least these reasons, singly or in combination, independent claim 1 is allowable over the art of record. Applicants also assert that any claims that depend from allowable claim 1 are also allowable.

§ 103 Rejection of claims 11, 12, 14, 15, 17 and 18 as obvious in view of Schultz in view of Birnboim (US 5023139)

Dependent Claims 11, 12, 14, 15, 17 and 18 stand rejected under 35 U.S.C. § 102(b) as being anticipated by *Birnboim et al.* The Examiner asserts that *Birnboim et al.* disclose "particles comprising a non-conducting inner layer (silica) surrounded by a metal shell (gold). *Birnboim et al.* disclose that by altering the shell thickness of the particles that they can be tuned from ultraviolet to infrared range of the electromagnetic spectrum." It is suggested by the Examiner that it would have been obvious to one of ordinary skill in the art to incorporate silica as taught by *Birnboim et al.* into the device of *Schultz et al.* because *Birnboim et al.* show that these particles provide for nonlinear optical materials which result in an increased polarization. Applicants respectfully traverse this rejection.

As described above, *Schultz et al* do not disclose particles having a shell layer with a thickness that is less than the thickness of a shell layer whose properties are described by a bulk dielectric property.

Likewise, *Birnboim et al.* do not teach or suggest nanoparticles in which "the thickness of said shell layer is less than that of a shell layer whose dielectric properties are described by a bulk dielectric function of a material comprising said shell layer." This limitation in claim 1 captures the distinction between the present invention and the disclosure of *Birnboim.* Namely, that *Birnboim* teaches only particles whose shells have bulk dielectric properties.

In view of the foregoing, it cannot be said that the combination of the teachings of *Birnboim et al.* with those of *Schultz et al* would produce nanoparticles in accordance with the present claims.

§ 103 Rejection of claims 19 and 20 as obvious in view of Schultz and the Sarkar paper

The Examiner asserts that it would have been obvious to substitute the gold shell particles of *Sarkar et al.* for the particles of *Schultz et al.* because those gold nanoshells possess "remarkable optical properties that differ dramatically from those of solid gold nanoparticles and that these particles provide for unique redshifting of the nanoparticle plasmon resonance to wavelengths in the visible and near infrared spectrum."

Applicants respectfully traverse this rejection and submit that even if one were to substitute the gold sulfide core and gold shell particle of *Sarkar et al.* for the particle of *Schultz et al.*, as suggested by the Examiner, one would still not have nanoparticles meeting the limitations of claim 1. A fair reading of the *Sarkar et al.* reference clearly distinguishes those particles from Applicants' particles because in *Sarkar et al.* it is made plain that the gold sulfide core radius necessarily grows at the same time that the gold shell is grown. Hence, in *Sarkar et al.* the radius of the core and the thickness of gold shell are not independent of each other. See page 4219, second column, for example, in *Sarkar et al.* By contrast, Applicants' claim 1 requires that the thickness of said shell layer be independent of the radius of said inner layer. Thus, *Sarkar et al.* clearly do not correct the deficiencies of *Schultz et al.*, as indicated above, and claim 1 is not obvious over the combination of *Schultz et al.* and *Sarkar et al.*

New Claim

New independent claim 21 has been added to more clearly recite the invention and to better ensure coverage of specific embodiments to which Applicants believe they are entitled. Applicants respectfully assert that this claim is patentable over the art of record.

Conclusion

This response to the Office Action of September 22, 2004, has addressed the rejections of each claim submitted in the application. Accordingly, the response is believed to be a complete response to the Office Action and reconsideration is appropriate. For the reasons stated above, the claims are now in condition for allowance and such favorable action is respectfully requested. If the Examiner has any questions or comments or otherwise feels it would be helpful, he is encouraged to telephone the undersigned at (713) 238-8057.

Respectfully submitted,

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